



Impact of Nurse-Led Home Visits on Foot Ulcer Prevention in Elderly Type 2 Diabetics: A Cluster Randomized Trial

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ABSTRACT

Foot ulcers are a prevalent and debilitating complication among elderly individuals with type 2 diabetes mellitus (T2DM), often resulting in increased morbidity, reduced mobility, and a heightened risk of lower limb amputation. As traditional outpatient models may fall short in addressing the preventive needs of this high-risk population, nurse-led home visits have emerged as a promising alternative. This review evaluated the impact of such interventions on foot ulcer prevention in elderly T2DM patients, synthesizing evidence from cluster randomized trials (CRTs). A narrative review methodology was employed, drawing insights from peer-reviewed CRTs that investigated clinical efficacy, behavioral outcomes, and implementation challenges associated with nurse-led home care models. Key components of these interventions include foot risk assessment, individualized education, self-care reinforcement, environmental hazard evaluation, and early referral for advanced care. Findings from CRTs consistently demonstrate a significant reduction in foot ulcer incidence and improvement in foot care practices among patients receiving home-based nursing care. Moreover, these interventions prove feasible and cost-effective, although challenges such as staffing limitations and reimbursement barriers persist. Nurse-led home visits not only enhance clinical outcomes but also align with broader goals of aging-in-place and chronic disease management. They represent a scalable and patient-centered strategy with substantial implications for geriatric diabetes care.

Keywords: Type 2 Diabetes Mellitus, Foot Ulcer Prevention, Nurse-Led Home Visits, Elderly Patients, Cluster Randomized Trials.

INTRODUCTION

Foot ulcers are a common and serious complication of type 2 diabetes mellitus (T2DM), particularly among the elderly [1, 2]. These ulcers often stem from a combination of peripheral neuropathy, peripheral vascular disease, and inadequate foot care, ultimately leading to increased risks of infection, hospitalization, and lower limb amputation [3, 4]. With aging populations globally and a corresponding rise in T2DM prevalence, elderly individuals represent a high-risk group for diabetes-related foot complications. The consequences are not only personal, in terms of mobility impairment and diminished quality of life, but also economic, imposing significant burdens on healthcare systems due to prolonged treatments and institutional care.

Preventive strategies are therefore essential to reduce the incidence of foot ulcers in this vulnerable population [5]. Traditional clinical approaches, while important, often fail to provide consistent and personalized care, especially for elderly individuals who may face barriers to frequent outpatient visits due to physical frailty, transportation challenges, or cognitive decline. Nurse-led interventions, particularly those administered in the home setting, offer a promising model of care that aligns with the principles of preventive medicine and patient-centered care.

Nurse-led home visits incorporate a range of activities, including patient education, routine foot inspections, risk assessment, early detection of skin and nail abnormalities, and reinforcement of self-care behaviors [6, 7]. By bringing care directly to the patient's environment, nurses can tailor interventions to individual needs and contexts, thereby potentially improving adherence and outcomes. This review examines the impact of nurse-led home visits on the prevention of foot ulcers in elderly patients with T2DM, drawing on evidence from cluster randomized trials.

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It explores the mechanisms through which such interventions influence clinical outcomes, evaluates their implementation feasibility, and discusses their potential role in reshaping chronic disease management for aging diabetic populations.

The Clinical Burden of Diabetic Foot Ulcers in the Elderly

Foot ulcers in elderly patients with T2DM represent a complex interplay of age-related physiological decline and diabetes-specific pathology [8]. Age exacerbates the risk of peripheral neuropathy and impairs wound healing, while diabetes accelerates microvascular and macrovascular damage. In addition, elderly individuals may experience diminished vision, arthritis, or cognitive impairment, all of which impede effective self-care and increase the likelihood of unnoticed foot trauma. Approximately 15% to 25% of diabetic patients are expected to develop foot ulcers during their lifetime, with the elderly disproportionately represented in this group [9, 10]. Once ulcers occur, the risk of recurrence is high, and even when ulcers heal, patients face ongoing vulnerability due to permanent nerve damage and deformities. Alarming, diabetic foot ulcers precede up to 85% of non-traumatic lower extremity amputations. Furthermore, foot ulcers are linked to increased all-cause mortality in elderly patients, often due to associated cardiovascular complications or infections such as osteomyelitis. The presence of a foot ulcer significantly diminishes quality of life, limits mobility, and increases dependence on caregivers or institutional care. Therefore, interventions focused on prevention rather than treatment are vital for improving outcomes in this high-risk population.

Principles and Components of Nurse-Led Home Visit Interventions

Nurse-led home visits represent a structured, proactive approach aimed at preventing foot complications through continuous, personalized, and context-sensitive care. These interventions are guided by nursing models of chronic disease management that emphasize education, empowerment, monitoring, and early intervention. Key components of nurse-led home visits typically include:

- i. **Risk Assessment:** Nurses perform comprehensive foot evaluations using standardized tools to identify high-risk features such as calluses, deformities, dry skin, diminished pulses, and neuropathy [11, 12].
- ii. **Education and Counseling:** Nurses educate patients and caregivers about proper foot hygiene, footwear selection, warning signs of complications, and lifestyle modifications including blood glucose control and smoking cessation.
- iii. **Self-care Reinforcement:** Interventions often include demonstrations of self-inspection techniques, trimming of nails, and guidance on moisturizing and offloading strategies to prevent pressure injuries.
- iv. **Monitoring and Referral:** Nurses track changes over time, document early signs of deterioration, and refer patients to podiatrists or physicians when advanced care is warranted.
- v. **Environmental Assessment:** Nurses evaluate home conditions, including flooring, furniture placement, and footwear use, to identify and mitigate environmental hazards that contribute to foot injury [13].

These multifaceted interventions are adaptable to patient needs and leverage the therapeutic nurse-patient relationship, which can enhance trust, adherence, and communication factors critical in geriatric care.

Evidence from Cluster Randomized Trials

Cluster randomized trials (CRTs) offer robust methodological frameworks for evaluating the effectiveness of nurse-led home visits in real-world settings [14, 15]. Unlike individually randomized trials, CRTs randomize groups such as primary care practices or geographic regions, thereby reducing contamination between intervention and control subjects, which is particularly important in community-based interventions.

Several CRTs have explored nurse-led interventions aimed at foot ulcer prevention. Results consistently demonstrate significant reductions in foot ulcer incidence, delayed onset of ulceration, and improvements in knowledge and foot care behaviors among intervention groups. One CRT involving elderly T2DM patients across multiple community clinics found that those receiving quarterly nurse-led home visits had a 40% lower incidence of new foot ulcers over 12 months compared to controls receiving usual care. Moreover, CRTs highlight the sustainability and scalability of these interventions. In studies where nurses received standardized training and used validated foot assessment tools, outcomes were reproducible across diverse populations. Additionally, some trials incorporated caregiver engagement, further enhancing patient support and long-term behavior change. Importantly, CRTs have also shown that the frequency and duration of visits matter. More frequent and longer visits are associated with greater reductions in ulceration rates, although this must be balanced against resource availability and workforce capacity.

Behavioral and Educational Impact on Patient Outcomes

Nurse-led home visits extend beyond physical assessment to address behavioral determinants of foot health [16]. Health behavior theories such as the Health Belief Model and Social Cognitive Theory underpin many educational strategies employed by nurses [17]. These frameworks help structure interventions to enhance perceived susceptibility to complications, build self-efficacy, and reinforce positive habits.

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For elderly patients, whose health beliefs may be influenced by long-standing experiences and cultural norms, tailored messaging is crucial. Nurse educators are trained to adapt content to cognitive and literacy levels, use visual aids, and involve family members when necessary. Research indicates that patients exposed to repeated in-home educational sessions demonstrate superior knowledge retention, better adherence to daily foot inspections, and improved footwear choices compared to those receiving clinic-based counseling alone. Additionally, the opportunity to ask questions in a familiar setting fosters greater engagement and clarifies misconceptions that may otherwise go unaddressed.

Behavioral reinforcement, facilitated by regular follow-up visits, helps consolidate new routines. For example, a patient who initially resists daily foot checks may, over time, adopt the practice after repeated encouragement and demonstration by the nurse.

Feasibility, Cost-Effectiveness, and Implementation Challenges

The feasibility of implementing nurse-led home visits on a scale depends on several interrelated factors: availability of trained nursing personnel, funding mechanisms, patient acceptance, and integration within existing care frameworks [18].

From a cost perspective, preventing a foot ulcer is significantly less expensive than treating one [19]. Studies estimate that preventive home visit programs incur only a fraction of the costs associated with hospitalization, surgery, or long-term wound care. Furthermore, preventing even a single amputation translates into substantial savings, not to mention preserved patient independence and dignity.

Implementation barriers include logistical challenges in rural or underserved areas, variability in nursing practice standards, and limited reimbursement for preventive home services in certain health systems. Moreover, nurses must balance competing demands and avoid scope-of-practice conflicts with other healthcare providers.

Addressing these challenges requires policy innovation, including reimbursement reform, workforce development, and interprofessional collaboration. Embedding nurse-led visits within chronic disease management programs or accountable care organizations may enhance sustainability and reach.

Broader Implications for Geriatric Diabetes Care

The impact of nurse-led home visits extends beyond foot ulcer prevention, offering a template for holistic, patient-centered care in elderly individuals with T2DM [20]. These visits can uncover unrecognized comorbidities, social isolation, nutritional deficiencies, or medication adherence issues, each of which influences diabetes outcomes. Moreover, the model aligns with the principles of “aging in place,” a concept that emphasizes supporting older adults to live safely and independently in their homes. By reinforcing functional independence and minimizing hospital encounters, nurse-led home care promotes dignity and quality of life.

Future innovations may involve the integration of telehealth tools to support hybrid models, where in-person visits are supplemented with virtual consultations or remote monitoring. Such approaches may enhance reach while preserving personalized care.

CONCLUSION

The prevention of foot ulcers in elderly patients with type 2 diabetes is a critical, yet often underprioritized, aspect of chronic disease management. Nurse-led home visits represent a highly effective and patient-centered strategy that addresses the unique vulnerabilities of this population. Evidence from cluster randomized trials consistently supports the role of these interventions in reducing foot ulcer incidence, enhancing self-care behaviors, and improving overall foot health. Beyond their clinical efficacy, nurse-led visits offer additional benefits in terms of behavioral reinforcement, environmental assessment, and caregiver engagement. While implementation challenges remain including logistical constraints and resource limitations these can be mitigated through thoughtful policy design, interprofessional collaboration, and integration with existing chronic care models. As health systems strive to optimize care for aging populations with complex needs, nurse-led home interventions emerge as a powerful tool in preventive medicine. Their continued evaluation, refinement, and expansion could significantly reduce the burden of diabetic foot disease and improve the quality of life for elderly individuals living with type 2 diabetes.

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